

Applying the Commissioning Process to the Building Envelope

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Agenda

- Identify problems of poorly designed and installed envelope systems
- Understand how commissioning addresses these problems
- Learn how to apply the commissioning process to the building envelope
- Case study

High technology = high quality?

- “Owners who think they have already paid for and are getting quality are engaging in denial. In far too many projects, cutting out quality has been the business norm, not the exception.”
 - Paul C. Tseng, “Building Commissioning: Benefits and Costs,” *HPAC* (April, 1998), p. 52.

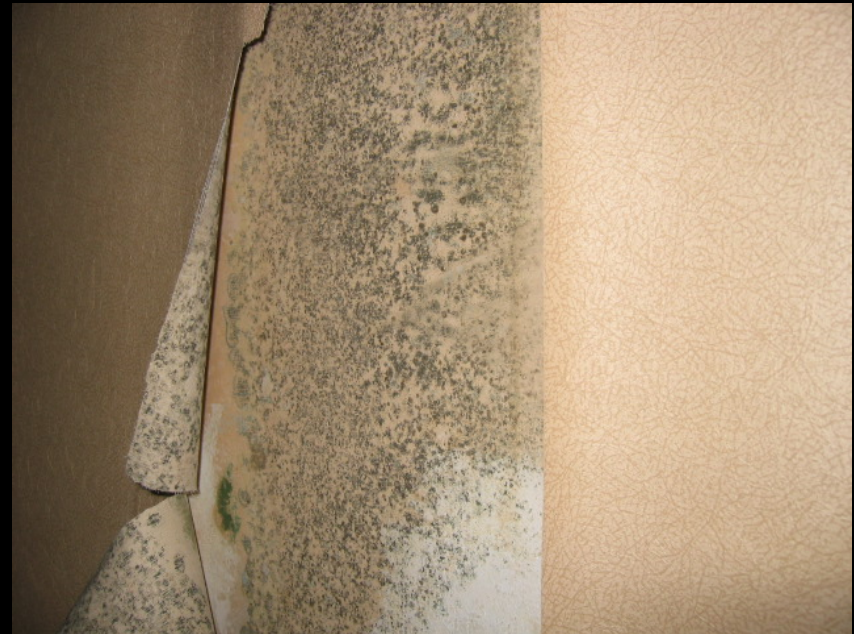
Consequences

- Poor indoor air quality
- Water intrusion
- Mold / mildew
- Decreased worker productivity
- Increased energy costs

IAQ

- “A recent study reported that 20-30% of commercial buildings suffer from indoor air quality problems.”

- *Ibid.*, p. 5.



Operating Costs

- “...operating costs for commissioned buildings are reported at 8-20% lower than those of a comparable non-commissioned building.”

”Building Commissioning,” (Washington, D.C.: U.S. General Services Administration), p. 6. Available at www.betterbricks.org.

How can commissioning help?

- Provides a systematic process to identify issues early in the project
- Provides quality assurance during design and construction
- Identify and resolve issues early in the process

Traditional Steps of Commissioning

- Develop Owner's Performance Requirements (OPR)
- Review Basis of Design
- Drawing Reviews
- Contractor Submittal Reviews

Traditional Steps of Commissioning

- Pre-functional Checklists
- Site Observation Visits During Construction
- Functional Testing
- Warranty Review
- Final Report

Can all of these steps be applied to the building envelope?

Owner's Performance Requirements

- Many formats including nominal group technique workshop
- Defines success criteria for project
- Often overlooks envelope

Basis of Design

- Traditional commissioning reviews the MEP basis of design
- CxA's first chance to review designer's vision for envelope
- Verify envelope will achieve OPR

Design Reviews

- Focused review of architectural systems
 - Drainage planes
 - Air barriers
 - Vapor barriers
 - Glazing assemblies
 - Roof

Design Reviews

- Verify constructability
- Look for ambiguities
- Compare design to OPR and BoD

Remember, change orders and RFIs add cost to the project!

Hygrothermal Map of North America Location, Location, Location!



“Understanding Vapor Barriers” by Lstiburek,
J. ASHRAE Journal,
2004.

Submittal Reviews

- Review product data
- Review shop drawings
- Compare to OPR and BoD
- Must occur in parallel with designer review

Pre-functional Checklists

- Goal is to do work right the first time
- Checklists supplement the design, they do NOT replace the design

Pre-functional Checklists

- Use the design drawings, specs, OPR, and BoD to create
- Get information to the contractor in simple, easy to understand language
- Convey quality expectations to contractor
- Helps the Owner track construction progress

Pre-functional Checklists

- Format:

- Yes or No questions
- Yes is always the correct answer
- No indicates a deficiency
- Keep it simple

Pre-functional Checklist

- Example questions for a slab vapor barrier:
 - Is the vapor barrier polyethylene with a minimum thickness of 10 mil?
 - Are vapor barrier layers installed with 6" of overlap?
 - Are edges sealed with tape along the entire length of lap?
 - Are edges turned up to within 1/2" of top of slab?

Site Observation Visits

- Periodic site visit to verify installation
- Document deficiencies
- Be specific, take photos
- Meet with contractor to discuss findings
- Generate report quickly to minimize schedule impact

Example: No Vapor Barrier



- Project did not include envelope commissioning
- Lack of vapor barrier was detected after walls were finished
- Major cost and schedule impact to repair

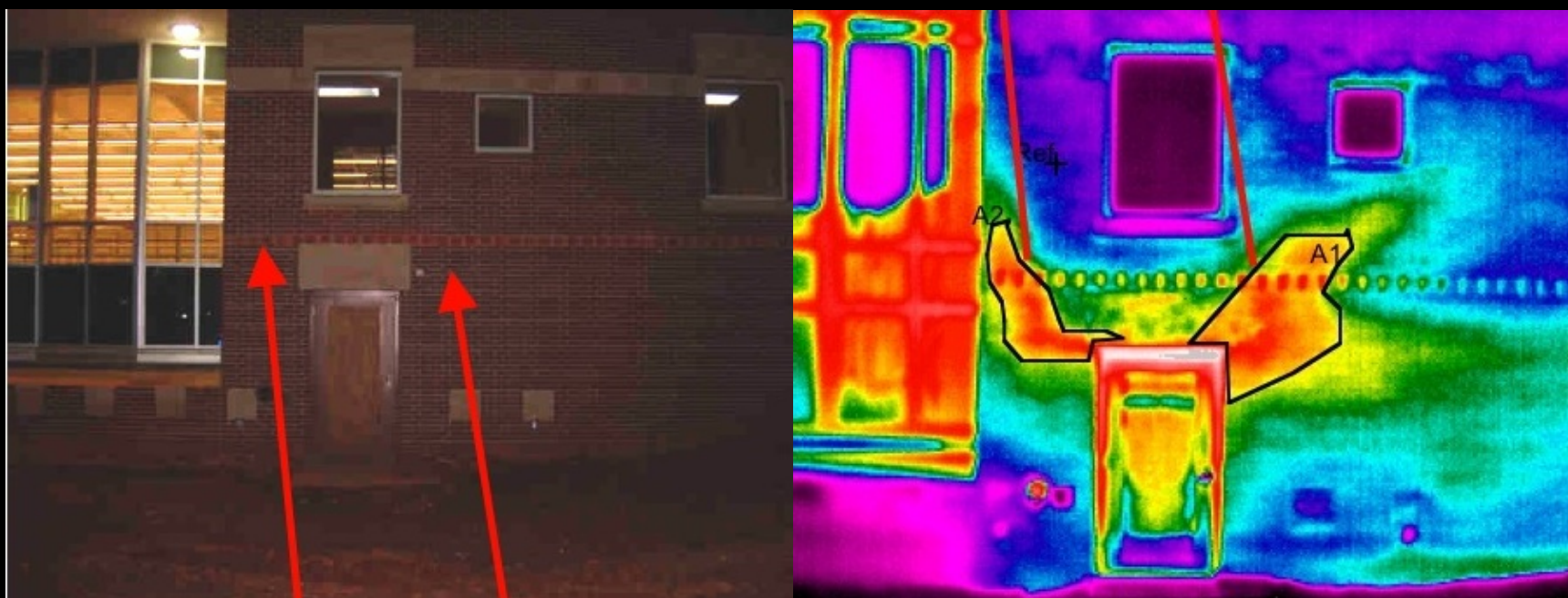
Functional Testing

- Verify installation meets OPR
- If Cx process is successful, no deficiencies found
- Should not be used strictly as a “punch-list” generating exercise

Functional Testing

- Lots of options for testing
 - Existing test procedures (ASTM)
 - Thermal imaging
 - Develop new test procedures

Example Thermal Image



Warranty Review

- Responsibilities during first year of warranty include:
 - Tracking issue resolution
 - Perform seasonal and/or deferred testing
 - Conduct lessons learned workshop
 - Review warranty items with facility operations staff

Case Study - Laboratory in Southeast

- High containment Laboratory space maintained at negative pressure on exterior of building
- envelope commissioning not included
- Vapor barrier not installed

Case Study

- Problem discovered during architectural punchlist walk-through
- Observed “bubbles” in epoxy paint on finished sheetrock



Case Study

- Repairs set project back by 6 weeks
- Several BSL-3 suites were torn down and reconstructed
- Extremely expensive repair

Case Study

- Estimated cost of envelope commissioning \$17k
- Estimated cost of not commissioning envelope \$50k + 6 weeks lost productivity

Conclusion

- Commissioning is a systematic quality assurance process
- Can be applied to ANY building system
- Goal is to catch issues early and provide a building that meets the Owner's Performance Requirements

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